

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-T-6736B

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Superseding AMS-T-6736A

Tubing, Chrome-Molybdenum (4130 or 8630) Steel, Seamless and Welded

RATIONALE

AMS-T-6736A has been designated cancelled as similar requirements are provided by AMS 6360, AMS 6361, and AMS 6362.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE International, as of January 2008. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been "CANCELLED". Cancelled specifications are available from SAE.

Similar, but not necessarily identical products are covered in the following specification. However, this listing is provided for information only and does not constitute authority to substitute these specifications for the "CANCELLED" specification.

- | | |
|----------|---|
| AMS 6360 | Steel Tubing, Seamless, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130) Normalized or Stress Relieved |
| AMS 6361 | Steel Tubing, Seamless, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130) 125 ksi (862 MPa) Tensile Strength |
| AMS 6362 | Steel Tubing, Seamless, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130) 150 ksi (1034 MPa) Tensile Strength |

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NOTICE

This document has been taken directly from U.S. Military Specification MIL-T-6736B, Notice 1 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-T-6736B, Notice 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE:

1.1 Scope:

This specification covers chromium-molybdenum (4130) seamless and welded steel tubing of aircraft quality.

1.2 Classification:

The tubing shall be of the following grades, types, and physical conditions, as specified (see 6.2):

Grades:

All tubing - Regular grade, except that type I, condition (N) tubing is also available in a special (S) grade having reduced decarburization limits.

Types:

Type I - Round
Type II - Rectangular or square
Type III - Streamline
Type IV - Oval

1.2 (Continued):

Physical conditions:

(A) - Annealed

(N) - Normalized or stress relieved

(HT-125) - Heat treated to a minimum tensile strength of 125,000 psi

(HT-150) - Heat treated to a minimum tensile strength of 150,000 psi

(HT-180) - Heat treated to a minimum tensile strength of 180,000 psi

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2301 Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure

AMS 2640 Magnetic Particle Inspection

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-I-6868 Inspection Process, Magnetic Particle

MIL-C-16173 Corrosion Preventive Compound, Solvent Cutback, Cold Application
Metals; Test Methods

FED-STD-151 Continuous Identification Marking of Iron and Steel Products

FED-STD-183 Marking for Shipment and Storage

MIL-STD-129 Steel Mill Products, Preparation for Shipment and Storage

MIL-STD-163 Tolerances - Seamless Steel Tubing, Aircraft Airframe, Round

MS33529 Tolerances - Welded Carbon and Alloy Steel Tubing

MS33530 Square and Rectangular Tubing - Carbon Steel and Alloy Steel, 0.35
Carbon, Maximum

MS33532 Standard Dimensions for Streamline and Oval Tubular Shapes

MS33534 Tubing - Standard Dimensions for Round Seamless Alloy Steel

AND10102

3. REQUIREMENTS:

3.1 Data:

Unless otherwise specified in the contract or order, no data are required by this specification or any of the documents referenced in section 2 (see 6.2).

3.2 Material:

The tubing shall be of aircraft quality. The material shall be magnetically inspected in accordance with the procedures of AMS 2301, and shall not exceed the size and frequency rating limits indicated in the paragraph entitled "Disposition" of AMS 2301 (see 4.5).

3.2.1 Manufacturing process: The steel shall be manufactured by the open-hearth or electric-furnace process, unless a single process is specified in the contract or purchase order.

3.2.1.1 Sufficient discard shall be taken from each ingot to ensure freedom from piping and undue segregation.

3.3 Chemical composition:

The chemical composition of tubing shall be as specified in Table I.

TABLE I. Chemical composition

| Element | Analysis, percent | Check analysis tolerance, ¹ percent |
|-----------------|-------------------|--|
| Carbon..... | 0.27-0.33 | ± 0.02 |
| Manganese..... | .40- .60 | ± .03 |
| Phosphorus..... | .025 (max) | + .005 |
| Sulfur..... | .025 (max) | + .005 |
| Silicon..... | .20-0.35 | ± .02 |
| Chromium..... | .80-1.10 | + .05, -0.03 |
| Molybdenum..... | .15-0.25 | ± .02 |

¹ Individual determinations may vary from the specified range to the extent shown in the check analysis column, except that elements in any heat shall not vary both above and below the specified range.

3.4 Mechanical properties:

After the last cold-draw pass, the tubing shall be normalized, stress relieved, or otherwise heat treated to develop the mechanical properties specified in table II.

TABLE II. Mechanical properties

| Condition and wall thickness | Tensile strength (min.) | Yield strength at 0.2 percent set or at extension indicated | | Elongation in 2 inches | |
|---------------------------------|-------------------------|---|----------------------|------------------------|--------------|
| | | (Min.) | Extension under load | Full tube (min.) | Strip (min.) |
| Inch | psi | psi | Inches in 2 inches | Percent | Percent |
| (A) ----- | ¹ 95, 000 | | | | |
| (N) ----- | | | | | |
| Up to 0.035 incl. ----- | 95, 000 | 75, 000 | 0. 0090 | 10 | 5 |
| Over 0.035 to 0.187 incl. ----- | 95, 000 | 75, 000 | . 0090 | 12 | 7 |
| Over 0.187 ----- | 90, 000 | 70, 000 | . 0087 | 15 | 10 |
| (HT-125) All walls ----- | 125, 000 | 100, 000 | . 0107 | 12 | 7 |
| (HT-150) All walls ----- | 150, 000 | 135, 000 | . 0130 | 10 | 6 |
| (HT-180) All walls ----- | 180, 000 | 165, 000 | . 0154 | 8 | 5 |

¹ Maximum.

3.5 Dimensions:

The dimensions of type I tubing shall conform to the standard dimensions shown on AND10102. The dimensions of types III and IV shall conform to the standard dimension shown on MS33534. The dimensions of type II tubing shall be as negotiated between the supplier and purchaser.

3.6 Length:

3.6.1 Exact lengths: Tubing of all sizes may be ordered to exact lengths or in lengths expressed as a multiple of a definite unit, with tolerances as specified in the contract or purchaser order.

3.6.2 Mill lengths: When exact or multiple lengths are not specified (see 6.2), tubing will be accepted in mill lengths of 5 to 20 feet, but not more than 10 percent of any order shall be furnished in lengths shorter than 12 feet.

3.7 Tolerances:

3.7.1 Type I: The permissible variations in dimensions of type I seamless tubing shall be as shown on MS33529 and for type I welded tubing as shown on MS33530.

3.7.2 Types II, III, and IV: The permissible variations in dimensions of all types II, III, and IV tubing shall be as shown on MS33532.

3.8 Grain size:

The austenitic grain size of the steel used for this tubing shall be predominantly No. 5 or finer, with grains as large as No. 3 permissible, as determined by the method specified in section 4. For seamless tubing, grain size shall be determined on a billet before piercing, hot working, or cold drawing.

3.9 Decarburization:

- 3.9.1 Regular grade: The average depth of total decarburization of regular grade, condition (N) tubing, as received from the tubing manufacturer, shall not exceed the amounts listed in table III. The depth of decarburization in table III is the total decarburization, or the sum of the depths of complete decarburization and partial decarburization on both the inner and outer surfaces of the tube. No more than 75 percent of the amount listed in table III is to appear on the outer surface of the tube. The depth of complete decarburization shall not exceed one-half the allowable total decarburization. (The word "average" means the results of several readings on a cross section of tubing.)
- 3.9.2 Special grade: The permissible decarburization of (S) grade, type I condition (N) tubing shall be one-half that listed in table III, with no complete decarburization permissible.

TABLE III - Decarburization limits

| Nominal (wall) thickness (inch) | Allowable total decarburization (ID+OD) (inch) | Maximum total decarburization (OD) (inch) |
|---------------------------------|--|---|
| Up to 0.040..... | 0.010 | 0.008 |
| 0.041 to 0.050..... | .012 | .009 |
| 0.051 to 0.070..... | .014 | .011 |
| 0.071 to 0.080..... | .016 | .012 |
| 0.081 to 0.090..... | .018 | .014 |
| 0.091 to 0.100..... | .020 | .015 |
| 0.101 to 0.150..... | .022 | .017 |
| 0.151 to 0.200..... | .026 | .020 |

3.10 Condition:

Unless otherwise specified, tubing shall be furnished in regular grade, type I, condition (N).

3.11 Identification of product:

Each tube shall be marked in accordance with FED-STD-183 and shall include the number of this specification.

3.12 Workmanship:

The tubing shall have a finish conforming to the best practice for aircraft quality material. It shall be smooth, clean, and free from heavy scale or oxide on the interior and exterior surfaces, and shall be free from burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious defects. Surface imperfections, such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered as injurious defects, provided the imperfections are removable without reducing the diameter or wall thickness of the tubing below the permissible tolerance limits. The removal of surface imperfections is not required.

3.12.1 Weld: The weld shall not contain defects greater than 1/16-inch long or depths greater than one-half the wall thickness. The welded tubing may be pickled or otherwise cleaned, if necessary, to meet surface conditions specified herein.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality conformance inspection:

The examination and testing of tubing shall be classified as quality conformance inspection.

4.2.1 Sampling and inspection shall be performed in accordance with FED-STD-151 and as specified herein. If the material is taken from stock and is not identifiable as to heat and method of manufacture, or if the identity of any portion of the shipment is obscure in any respect, additional samples shall be selected to determine conformance of all portions of the shipment to this specification.

4.3 Lot:

A lot shall consist of tubing produced from the same heat and which is essentially homogeneous in all respects, in the same condition, of the same type, size, and wall thickness offered for delivery at the same time.

4.4 Examinations:

4.4.1 Examination of product: Each length of tubing shall be visually examined for compliance with surface condition and workmanship requirements. Samples selected in accordance with table IV shall be examined to assure compliance with the specified dimensions and tolerances, and identification marking requirements.

TABLE IV. Sampling plan

| Lot size | Sample size | Acceptance number rejectable |
|-----------------|-------------|------------------------------|
| 1 to 15..... | All | 0 |
| 16 to 180..... | 15 | 0 |
| 181 to 300..... | 35 | 0 |
| 301 to 500..... | 50 | 1 |
| Over 500..... | 75 | 2 |

4.4.2 Examination of preparation for delivery: Preparation for delivery shall be examined for conformance to section 5.

4.5 Magnetic inspection:

Specimens shall be selected, inspected, and rated in accordance with the procedures of AMS 2301. Inspection shall be in accordance with MIL-I-6868 or AMS 2640.

4.6 Chemical analysis:

4.6.1 Sampling: At least one sample shall be selected for check chemical analysis in accordance with FED-STD-151 to represent each heat in the lot. The sample shall consist of not less than 2 ounces.

4.6.2 Method: Specimens shall be prepared in accordance with Methods 111 or 112 of FED-STD-151, and shall be tested by wet chemical or spectrochemical methods. In the event of dispute, analysis shall be by wet chemical methods.

4.6.3 Waiver: Samples for check of chemical analysis may be waived provided that all of the material in the lot can be identified as being made from a heat previously analyzed and found to conform to the chemical composition specified herein.

4.7 Tensile test:

4.7.1 Sampling: At least one tensile test sample shall be selected from each 1,000 feet or less of each lot for determination of mechanical properties.

4.7.2 Preparation of specimens: Tensile test specimens shall be prepared in accordance with Method 211 of FED-STD-151.

4.7.3 Method: Tensile tests and determination of yield strength and elongation shall be conducted in accordance with Method 211 of FED-STD-151.